Mechanical Engineering, M.S.

Research

The mechanical engineering graduate program in the College of Engineering emphasizes in-depth learning and research. In collaboration with faculty across campus, the faculty are currently researching a diverse range of topics within the field. For more information, see the Department of Mechanical Engineering website.

Design and Uncertainty Quantification

The Design and Uncertainty Quantification focus area is concerned with design optimization of complex mechanical systems in the presence of uncertainty. The focus area emphasizes developments of sound theoretical foundation, novel computational methods and algorithms, and modern software tools aimed at creating state-of-the-art engineering design of automotive, aerospace, naval, nuclear, and biomedical systems. Current areas of excellence include artificial muscles and smart materials design, ship hydrodynamics, design sensitivity analysis, uncertainty quantification, and reliability-based design optimization.

Fluid Dynamics

The Fluid Dynamics focus area covers a wide variety of topics with flow of liquids and gases as the common denominator. The graduate program in fluid dynamics emphasizes fundamental principles and applications, and the numerical and experimental techniques used to obtain and analyze fluid flows. Areas of concentration include computational fluid dynamics, experimental fluid dynamics, medical flows, naval hydrodynamics, biologically-inspired air and underwater vehicles, multiphase flows, cavitation and ventilation, and fluid-structure interaction and turbulence, among others.

Heat Transfer and Combustion

The Heat Transfer and Combustion focus area applies to real-world systems in manufacturing and materials processing, propulsion, energy production, and other areas. The graduate program emphasizes fundamental principles and techniques required for experimental and theoretical research. Current areas of research include solidification of materials, metal casting, 3-D printing, laser-materials interaction, power plants and propulsion devices such as automobile and aircraft engines, energy conservation and production, energy storage, complex reactive materials, and machine learning in computational modeling and simulation.

Manufacturing and Materials

The Manufacturing and Materials focus area involves fundamental materials processing science, technological advancement in manufacturing applications, and development of new manufacturing processes and new material functions. Current and emerging thrust areas include solidification, metal casting, laser materials processing, micro- and nanofabrication, joining, ultrasonic welding, machining, microstructure evolution, manufacturing process modeling and simulation, artificial muscles, artificial camouflage, smart materials, and material characterizations. These research activities are well supported by federal and state agencies and the manufacturing industry.

Robotics, Controls, and Autonomous Systems

Robotics, Controls and Autonomous Systems (RCAS) are concerned with the modeling, analysis, design, and control of dynamic systems. The graduate program in RCAS emphasizes fundamental principles and techniques of robotics, control theory, and artificial intelligence. Areas of concentration include computational intelligence, dynamic autonomous systems, cyber-physical systems, and networked robotic systems with potential applications in self-driving cars; medical and assistive robots for surgery and rehabilitation; industrial co-robots for human-robot collaboration; and uncrewed aerial, ground, and underwater vehicles.

Solid Mechanics and Multibody Dynamics

Solid Mechanics and Multibody Dynamics are concerned with the behavior of solid materials and flexible bodies, especially their deformation, motion, and stress responses under the action of applied loads. The graduate program in solid mechanics and multibody dynamics emphasizes the theoretical foundations and problem-solving techniques for engineering applications. Current research focuses of the faculty include multiscale mechanics of materials, biomechanics, vehicle dynamics, computational mechanics, multibody dynamics, and optimization.

Requirements

The Master of Science program in mechanical engineering requires a minimum of 30 s.h., with or without thesis. Thesis students may count 6-9 s.h. earned for thesis research and writing toward the degree. Students must maintain a g.p.a. of at least 3.00 in graduate work used to satisfy their degree requirements.

Each student determines a study plan in consultation with an advisor and submits the plan to the department chair for approval. Students must complete ENGR:7270 Engineering Ethics during their first fall semester in the program. All M.S. students must register for ME:6191 Graduate Seminar: Mechanical Engineering each fall and spring semester until successful completion of their final examination or thesis defense.

Students must be successful in their final examination. The examination is administered by a student's committee, which consists of at least three faculty members, including at least one with a primary appointment in the Department of Mechanical Engineering.

The requirements for the M.S. may be completed within one calendar year. However, students with assistantship duties or other constraints may take up to two calendar years to complete the degree.

Admission

Applicants must meet the admission requirements of the Graduate College; for detailed information about Graduate College policies, see the Manual of Rules and Regulations of the Graduate College on the Graduate College website.

Applicants who have earned a baccalaureate or master's degree in engineering curriculum or in the mathematical or physical sciences are eligible to be considered for admission to graduate study in mechanical engineering. In order to be considered for regular admission, applicants must have a
g.p.a. of at least 3.00 on a 4.00 scale on all previous college-
level work and Graduate Record Examination (GRE) General
Test scores of at least 500 verbal, 750 quantitative, and 4.5 in
analytical writing. Students whose first language is not English
must score at least 81 (Internet-based) on the Test of English
as a Foreign language (TOEFL).

Applicants with a lower grade-point average and/or GRE
or TOEFL test scores may be considered for conditional
admission, under exceptional circumstances. Applicants
admitted conditionally must achieve regular standing within
one semester (excluding summer sessions) after admission
by attaining a g.p.a. of at least 3.00 on their first 9 s.h. at the
University of Iowa. The Graduate College cancels registration
for the subsequent semester for students who have not
submitted their GRE and/or TOEFL scores by the end of the
first semester after admission.

Financial Support

Financial support is available to M.S. students, primarily
through graduate assistantships in teaching or research from
the Department of Mechanical Engineering, the Center for
Computer-Aided Design, IIHR—Hydroscience and Engineering,
and the National Advanced Driving Simulator. These awards
may be made on a semester, academic year, or calendar year
basis. Awards and reappointments are competitive and are
based on a student's potential contribution to the teaching
and research goals of the department. Students who fulfill
their assistantship responsibilities and continue to make
satisfactory progress toward their degree objective receive
preference in new assistantship awards. All applications
for financial support should be submitted directly to the
department chair.

Students with assistantship appointments of one-quarter-time
or more are required to register for a minimum of 9 s.h. during
fall and spring semesters until they have completed 30 s.h. of
course and research work beyond the baccalaureate degree.

Career Advancement

The engineering profession is a foundation for a variety
of careers in industry, medicine, law, government, and
consulting. On average, 93-98 percent of graduates are
employed in their field of study or pursuing advanced
education within seven months of graduation.

Engineering Professional Development (EPD) develops
and promotes experiential education and professional
opportunities for students in the College of Engineering.
Professional staff coordinate the college's co-op and
internship program, engage in employer outreach, and
provide opportunities for students to network with employers,
including an engineering career fair each semester and other
programming related to career development.

EPD also offers individual advising and class presentations
on résumé and cover letter preparation, job and internship
search strategies, interviewing skills, and job offer evaluation.